AMENDMENTS TO THE DRAWINGS

1. Figure 1

Figure 1 has been amended to include the laser 120 referred to in the Specification (*e.g.*, in paragraph [0015]).

REMARKS

In view of the following discussion, the Applicant submits that none of the claims now pending in the application is made obvious under the provisions of 35 U.S.C. §103. Thus, the Applicant believes that all of these claims are now in allowable form.

I. OBJECTION TO THE DRAWINGS

The drawings stand objected to under 37 C.F.R §1.83(a) for allegedly failing to show every feature of the invention specified in the claims. In response, the Applicant has amended Figure 1 in order to more clearly illustrate the invention.

In particular, the laser 120 (referred to, for example, in paragraph [0015]) of the specification, has been amended into Figure 1. The Applicant submits that the omission of the laser in the original Figure 1 was an oversight, but that the presence of the laser is supported by the specification.

In view of this amendment, the Applicant respectfully requests that the objection to the drawings be withdrawn.

II. OBJECTION TO CLAIMS 8, 15, 18 AND 20

Claims 8, 15, 18 and 20 stand objected to for informalities. In response, the Applicant has amended claims 8, 15, 18 and 20 to more clearly recite aspects of the present invention.

In particular, claim 8 has been amended, as suggested by the Examiner, to recite a probe comprising "a Gd-Fe alloy, a Gd-Co alloy, a Tb-Fe alloy, a Tb-Co alloy, a Dy-Fe alloy or a Dy-Co alloy", replacing "a (Gd, Tb, Dy)-(Fe, Co) alloy".

Claim 15 has been amended to recite a probe comprising "a transparent material coated with said magnetic coating", replacing "a transparent material coated with a heat-conducting material".

Claims 18 and 20 have been amended, as suggested by the Examiner, to recite a cantilever "that oscillates", replacing a cantilever "adapted for oscillating".

In view of these amendments, the Applicant respectfully requests that the objection to claims 8, 15, 18 and 20 be withdrawn.

III. REJECTION OF CLAIMS 1-21 UNDER 35 U.S.C. § 102

1. Claims 1-5, 7-8, 10-12 and 14

Claims 1-5, 7-8, 10-12 and 14 stand rejected as being made obvious by the Kado et al. patent (United States Patent No. 6,101,164, issued August 8, 2000, hereinafter "Kado"). The Applicant respectfully traverses the rejection.

Kado teaches a conductive probe contact for use in high-density recording. The probe is positioned proximate to a recording surface of a recording medium. Information is recorded on the recording medium by heating the recording medium in the area of the probe such that a physical state of the recording medium is changed in the area of the probe. In one embodiment (referred to by the Examiner as Kado Embodiment One or KE1), the tip of the probe is comprised of a conductive magnetic material. In another embodiment (referred to by the Examiner as Kado Embodiment Two or KE2), the probe is heated by a laser beam.

The Examiner's attention is directed to the fact that KE1 and KE2, singly or in any permissible combination, fail to teach, show or suggest heating a probe that is comprised of a material having temperature-dependent magnetic properties, as positively claimed by the Applicant. Specifically, Applicant's independent claim 1 recites:

> 1. A method for performing magnetic force microscopy comprising:
> providing a probe comprising a material having temperature-dependent magnetic properties, the probe having a tip adapted for observing a surface of a sample; and
> heating the probe. (Emphasis added)

The Applicant's invention is directed to the field of magnetic force microscopy (MFM). Most common methods of performing MFM produce results (*i.e.*, images of samples) that are difficult to interpret due to the presence of both magnetic and non-magnetic forces. Conventional attempts to separate the magnetic and non-magnetic

forces often rely on repeat scans of the samples, which is slow and can also degrade the magnetic information.

The Applicant's invention is directed to a method and apparatus for tunable magnetic force interaction in an MFM microscope. In one particular embodiment, an MFM microscope includes a probe that is comprised of a material having temperature-dependent magnetic properties. The probe is heated with a time-varying heat source such that the magnetic moment of the probe tip (and correspondingly the magnetic field interaction between the probe tip and the sample) is oscillated, thereby substantially separating the magnetic force components of a measurement from the non-magnetic force components at any time and position over the sample.

By contrast, Kado only teaches changing the properties of the "sample" (in Kado's case, a recording medium) by heating. That is, the recording medium is, in some embodiments, coated with a magnetic material (Tb, Fe or Co) whose magnetization direction is manipulated by heating. This is not the same as changing the properties of the probe by heating.

The Applicant's invention varies the magnetic properties of the probe tip by heating. Because the probe tip is coated with a material that has temperature-dependent magnetic properties, these properties can be oscillated by applying a time-varying heat source. The oscillation of the probe's magnetic properties (and consequently of the magnetic field between the probe and the sample) facilitates true magnetic measurement of the sample (*e.g.*, substantially free of non-magnetic forces). Neither KE1 nor KE2, nor any other portion of Kado, teaches or suggests varying the magnetic properties of the probe by coating it with a material having temperature-dependent magnetic properties and then heating it.

As the Examiner acknowledges on page 4 of the Office Action, KE1 does not teach heating a probe including a material having temperature-dependent magnetic properties. Moreover, the portions of KE2 that the Examiner cites to support the rejection also do not teach heating a probe including a material having temperature-dependent magnetic properties. At most, KE2 teaches that the probe tip comprises "a

conductive magnetic material having a large magnetic permeability" (*see*, Kado, column 22, lines 50-51). This does not equate to the probe tip (or the probe tip material) having temperature-dependent magnetic properties. In fact, KE2 says nothing about the magnetic properties of the probe tip being affected by temperature.

Therefore, Applicant respectfully submits that independent claim 1 is clearly patentable and not made obvious by Kado. Furthermore, dependent claims 2-5, 7-8, 10-12 and 14 depend, either directly or indirectly, from claim 1 and recite additional limitations therefor. As such, and for at least the exact same reason set forth above, the Applicant submits that claims 2-5, 7-8, 10-12 and 14 are also patentable and not made obvious by Kado. Accordingly, the Applicant respectfully requests that the rejection of claims 1-5, 7-8, 10-12 and 14 under 35 U.S.C. § 103 be withdrawn.

2. Claim 6

Claim 6 stands rejected as being made obvious by Kado in view of the Gottschalk patent (United States Patent No. 6,573,817, issued June 3, 2003, hereinafter "Gottschalk"). The Applicant respectfully traverses the rejection.

Kado has been discussed above. Gottschalk teaches a variable-strength multi-pole beamline magnet. Specifically, Gottschalk teaches a magnet having a plurality of stationary poles formed of ferromagnetic material and one or more permanent magnets disposed between the stationary poles. Each permanent magnet supplies magnetomotive force to the adjacent stationary poles, such that the stationary poles produce a magnetic field in a central space defined by the poles, through which the mechanical axis of the magnet extends. The mechanical axis includes a linear drive that is adapted to move the permanent magnets perpendicularly to the mechanical axis.

As discussed above, Kado (and specifically KE1 and KE2 of Kado) fails to teach, show or suggest heating a probe that is comprised of a material having temperature-dependent magnetic properties, as positively claimed by the Applicant in independent claim 1, recited above. Gottshalk fails to bridge this gap in the teachings of Kado.

Therefore, Applicant respectfully submits that independent claim 1 is clearly

patentable and not made obvious by Kado in view of Gottshalk. Furthermore, dependent claim 6 depends from claim 1 and recites additional limitations therefor. As such, and for at least the exact same reason set forth above, the Applicant submits that claim 6 is also patentable and not made obvious by Kado in view of Gottshalk. Accordingly, the Applicant respectfully requests that the rejection of claim 6 under 35 U.S.C. § 103 be withdrawn.

3. Claim 9

Claim 9 stands rejected as being made obvious by Kado in view of the Farina et al. patent (United States Patent No. 5,856,880, issued January 5, 1999, hereinafter "Farina"). The Applicant respectfully traverses the rejection.

Kado has been discussed above. Farina teaches a method for laser-assisted thermo-electric poling of ferroelectric material. According to Farina, a ferroelectric material is selectively poled by first heating a surface of the material at a temperature near the material's Curie temperature, but below the material's melting temperature. The heating is done using a light beam (*e.g.*, a laser) and is performed while applying an electric field to the heated region having a component along the desired polarization direction. The material is then allowed to cool with the electric field in place.

As discussed above, Kado (and specifically KE1 and KE2 of Kado) fails to teach, show or suggest heating a probe that is comprised of a material having temperature-dependent magnetic properties, as positively claimed by the Applicant in independent claim 1, recited above. Farina fails to bridge this gap in the teachings of Kado.

Therefore, Applicant respectfully submits that independent claim 1 is clearly patentable and not made obvious by Kado in view of Farina. Furthermore, dependent claim 9 depends from claim 1 and recites additional limitations therefor. As such, and for at least the exact same reason set forth above, the Applicant submits that claim 9 is also patentable and not made obvious by Kado in view of Farina. Accordingly, the Applicant respectfully requests that the rejection of claim 9 under 35 U.S.C. § 103 be withdrawn.

4. Claim 13

Claim 13 stands rejected as being made obvious by Kado in view of the McCulloch et al. patent (United States Patent No. 5,031,126, issued July 9, 1991, hereinafter "McCulloch"). The Applicant respectfully traverses the rejection.

Kado has been discussed above. McCulloch teaches a constant-power thermal analysis sensor that compensates for changes in the temperature of a medium into which the sensor is placed. In particular, McCulloch teaches a sensor having two side-by-side probes having resistances that vary with temperature. The probes are mounted in the medium, and a constant power source produces a current through the first probe, while a current source applied a current to the second probe at a fixed ratio of the current in the first probe. A signal produced by the sensor is representative of the heat transfer between the two probes and the medium.

As discussed above, Kado (and specifically KE1 and KE2 of Kado) fails to teach, show or suggest heating a probe that is comprised of a material having temperature-dependent magnetic properties, as positively claimed by the Applicant in independent claim 1, recited above. McCulloch fails to bridge this gap in the teachings of Kado.

Therefore, Applicant respectfully submits that independent claim 1 is clearly patentable and not made obvious by Kado in view of McCulloch. Furthermore, dependent claim 13 depends from claim 1 and recites additional limitations therefor. As such, and for at least the exact same reason set forth above, the Applicant submits that claim 9 is also patentable and not made obvious by Kado in view of McCulloch. Accordingly, the Applicant respectfully requests that the rejection of claim 13 under 35 U.S.C. § 103 be withdrawn.

5. Claims 15-17

Claims 15-17 stand rejected as being made obvious by Kado in view of the Michaels patent (United States Patent No. 4,968,314, issued November 6, 1990, hereinafter "Michaels"). The Applicant respectfully traverses the rejection.

Kado has been discussed above. Michaels teaches a surgical apparatus for medical uses (*e.g.*, ablation of atheroma, destruction of calculi and lithotripsy). The surgical apparatus includes a waveguide (*e.g.*, an optical fiber) through which laser energy is applied to organic tissues. The waveguide passes through an end piece, the tip of which may be made reflective or absorptive of the laser radiation, and which may further include a sensing means.

As discussed above, Kado (and specifically KE1 and KE2 of Kado) fails to teach, show or suggest heating a probe that is comprised of a material having temperature-dependent magnetic properties, as positively claimed by the Applicant in independent claim 1, recited above. Michaels fails to bridge this gap in the teachings of Kado.

Therefore, Applicant respectfully submits that independent claim 1 is clearly patentable and not made obvious by Kado in view of Michaels. Furthermore, dependent claims 15-17 depend from claim 1 and recite additional limitations therefor. As such, and for at least the exact same reason set forth above, the Applicant submits that claims 15-17 are also patentable and not made obvious by Kado in view of Michaels. Accordingly, the Applicant respectfully requests that the rejection of claims 15-17 under 35 U.S.C. § 103 be withdrawn.

6. Claims 18-19

Claims 18-19 stand rejected as being made obvious by the Kitamura patent (United States Patent No. 6,504,365, issues January 7, 2003, hereinafter "Kitamura") in view of Kado and further in view of Gottshalk. The Applicant respectfully traverses the rejection.

Kado and Gottshalk have been discussed above. Kitamura teaches a magnetic force microscope (MFM). The MFM includes a magnetized cantilever having a probe attached to its free end and an oscillation means for exciting the cantilever into oscillation. Various control means operate to monitor and control the position and oscillation of the cantilever relative to the sample at given times

The Examiner's attention is directed to the fact that Kitamura, like Kado and

Gottshalk, fails to teach, show or suggest heating a probe tip comprising a low Curie temperature material, as positively claimed by the Applicant. Specifically, Applicant's independent claim 18 recites:

> 18. A magnetic force microscope comprising:
> a cantilever adapted for oscillating, wherein the cantilever has a first end and a second end;
> a probe coupled to the second end of the cantilever, wherein the probe has a tip comprising a low Curie temperature material;
> a laser adapted for illuminating the second end of the cantilever;
> an optical detector adapted for detecting light reflected by the cantilever; and
> a heat source adapted for heating the probe. (Emphasis added)

As discussed above, the Applicant's invention varies the magnetic properties of the probe tip by heating. Because the probe tip is comprised of a material that has a low Curie temperature (*e.g.*, a temperature at which a material's magnetic moment is "quenched"), modulation of the probe tip's magnetic moment is facilitated within certain obtainable ranges of temperature. The modulation of the probe's magnetic properties (and consequently of the magnetic field between the probe and the sample) facilitates true magnetic measurement of the sample (*e.g.*, substantially free of non-magnetic forces). None of Kitamura, Kado and Gottshalk, teaches or suggests varying the magnetic properties of the probe by forming the tip of a low Curie temperature material and then heating it.

As the Examiner acknowledges on page 11 of the Office Action, Kitamura does not teach heating a probe including a tip that has a low Curie temperature. Moreover, the portions of Kado that the Examiner cites to support the rejection also do not teach heating a probe or probe tip formed of a low Curie temperature material. At most, Kado teaches that the probe tip comprises "a conductive magnetic material having a large magnetic permeability" (*see*, Kado, column 22, lines 50-51). This does not equate to the probe tip (or the probe tip material) having a low Curie temperature. In fact, the only time in which the Curie temperature of any component comes into play in Kado concerns the Curie temperature of the magnetic material coating the recording medium.

In such instances, it is taught that the recording medium is heated to a temperature exceeding the Curie temperature of the magnetic material, but Kado does not give any preferred value or range for the Curie temperature of the material and certainly states no preference for the material to have a Curie temperature that is low.

Gottshalk teaches a passive temperature compensation means comprising ferromagnetic materials having low Curie temperatures magnetically coupled to the permanent magnets. The purpose of this coupling is to compensate for temperature dependent flux variations of the permanent magnets, which may affect the strength of the magnetic field. The present invention employs a low Curie temperature material into a probe tip in order to encourage or facilitate variations in the probe tip's magnetic moment. Thus, the motivation for using low Curie temperature materials is different in each application. It therefore does not follow that a person looking to improve upon an MFM would look to beamline magnet technology, which is more commonly associated with particle accelerator technology.

Therefore, Applicant respectfully submits that independent claim 18 is clearly patentable and not made obvious by Kitamura in view of Kado and further in view of Gottshalk. Furthermore, dependent claim 19 depends from claim 18 and recites additional limitations therefor. As such, and for at least the exact same reason set forth above, the Applicant submits that claim 19 is also patentable and not made obvious by Kitamura in view of Kado and further in view of Gottshalk. Accordingly, the Applicant respectfully requests that the rejection of claims 18-19 under 35 U.S.C. § 103 be withdrawn.

7. Claims 20- 21

Claims 20-21 stand rejected as being made obvious by Kitamura in view of Kado. The Applicant respectfully traverses the rejection.

Kitamura and Kado have been discussed above. The Examiner's attention is directed to the fact that Kitamura and Kado, singly and in any permissible combination, fail to teach, show or suggest heating a probe tip comprising a ferrimagnetic material, as

positively claimed by the Applicant. Specifically, Applicant's independent claim 20 recites:

> 20. A magnetic force microscope comprising:
> a cantilever adapted for oscillating, the cantilever having a first end and a second end;
> a probe coupled to the second end of the cantilever, the probe having a tapered tip comprising a ferrimagnetic material;
> a motion detector adapted for detecting deflection of the cantilever; and
> a heat source adapted for heating the probe.
> (Emphasis added)

As discussed above, the Applicant's invention varies the magnetic properties of the probe tip by heating. Because the probe tip is comprised of a material that is ferrimagnetic, modulation of the probe tip's magnetic moment is facilitated. The modulation of the probe's magnetic properties (and consequently of the magnetic field between the probe and the sample) facilitates true magnetic measurement of the sample (*e.g.*, substantially free of non-magnetic forces). Neither Kitamura nor Kado teaches or suggests varying the magnetic properties of the probe by forming the tip of a ferrimagnetic material and then heating it.

As the Examiner acknowledges on page 13 of the Office Action, Kitamura does not teach heating a probe including a tip formed of a ferrimagnetic material. Moreover, the portion of Kado that the Examiner cites to support the rejection also does not teach heating a probe or probe tip formed of a ferrimagnetic material. Specifically, the portion of Kado that the Examiner cites describes using various compounds including Dy-Fe to coat the recording medium ("Although ... Tb-Fe-Co is used as the magnetic material used for the recording medium, it is not so limited but any amorphous material comprising at least one selected from the group consisting of Tb, Gd and Dy. For example, Gd compounds such as .... Dy-Fe ... can be used as well". *See*, Kado, column 23, lines 24-30, emphasis added).

Therefore, Applicant respectfully submits that independent claim 20 is clearly

patentable and not made obvious by Kitamura in view of Kado. Furthermore, dependent claim 21 depends from claim 20 and recites additional limitations therefor. As such, and for at least the exact same reason set forth above, the Applicant submits that claim 21 is also patentable and not made obvious by Kitamura in view of Kado. Accordingly, the Applicant respectfully requests that the rejection of claims 20-21 under 35 U.S.C. § 103 be withdrawn.

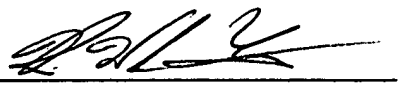
IV. CONCLUSION

Thus, the Applicant submits that all of the presented claims fully satisfy the requirements of 35 U.S.C. §103. Consequently, the Applicant believes that all of the presented claims are presently in condition for allowance. Accordingly, both reconsideration of this application and its swift passage to issue are earnestly solicited.

If, however, the Examiner believes that there are any unresolved issues requiring the issuance of a final action in any of the claims now pending in the application, it is requested that the Examiner telephone Mr. Kin-Wah Tong, Esq. at (732) 530-9404 so that appropriate arrangements can be made for resolving such issues as expeditiously as possible.

Respectfully submitted,

10/20/05
Date



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